Technical Paper 282

AD

THE PERCEPTION OF TACTICAL INTELLIGENCE INDICATIONS: A REPLICATION

Edgar M. Johnson

BATTLEFIELD INFORMATION SYSTEMS TECHNICAL AREA

U. S. Army

Research Institute for the Behavioral and Social Sciences

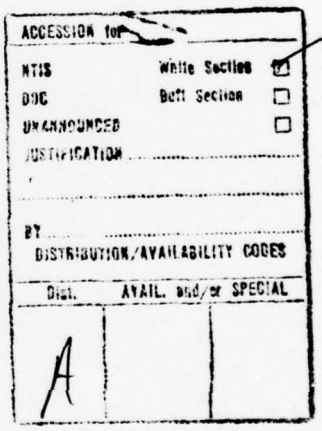
September 1977

U. S. ARMY RESEARCH INSTITUTE
FOR THE BEHAVIORAL AND SOCIAL SCIENCES

A Field Operating Agency under the Jurisdiction of the Deputy Chief of Staff for Personnel

J. E. UHLANER
Technical Director

W. C. MAUS
COL, GS
Commander



NOTICES

DISTRIBUTION: Primary distribution of this report has been made by ARI. Please address correspondence concerning distribution of reports to: U. S. Army Research Institute for the Behavioral and Social Sciences, ATTN: PERI-P, 5001 Eisenhower Avenue, Alexandria, Virginia 22333.

FINAL DISPOSITION: This report may be destroyed when it is no longer needed. Please do not return it to the U. S. Army Research Institute for the Behavioral and Social Sciences.

NOTE: The findings in this report are not to be construed as an official Department of the Army position, unless so designated by other authorized documents.

Unclassified

SECURITY CLASSIFICATION OF THIS PAGE (When Data Entered)

REPORT DOCUMENTATION PAGE		READ INSTRUCTIONS BEFORE COMPLETING FORM
1. REPORT NUMBER (14) ARI- Technical Paper-282	2. GOVT ACCESSION NO.	3. RECIPIENT'S CATALOG NUMBER
4. TITLE (and Subtitle) (6) THE PERCEPTION OF TACTICAL INTELLIGENCE INDICATIONS: A REPLICATION,		5. TYPE OF REPORT & PERIOD COVERED 6. PERFORMING ORG. REPORT NUMBER
7. AUTHOR(s) (10) Edgar M. Johnson		8. CONTRACT OR GRANT NUMBER(s)
9. PERFORMING ORGANIZATION NAME AND ADDRESS U.S. Army Research Institute for the Behavioral and Social Sciences, 5001 Eisenhower Avenue, Alexandria, VA 22333		10. PROGRAM ELEMENT, PROJECT, TASK AREA & WORK UNIT NUMBERS (16) 2Ø662ıØıA754
11. CONTROLLING OFFICE NAME AND ADDRESS U.S. Army Combined Arms Combat Development Activity (CACDA) Fort Leavenworth, KS 66027		12. REPORT DATE (11) Sept [redacted] 77 13. NUMBER OF PAGES 45 (12) 44p.
14. MONITORING AGENCY NAME & ADDRESS (if different from Controlling Office)		15. SECURITY CLASS. (of this report) Unclassified 15a. DECLASSIFICATION/DOWNGRADING SCHEDULE

16. DISTRIBUTION STATEMENT (of this Report)

Approved for public release; distribution unlimited.

17. DISTRIBUTION STATEMENT (of the abstract entered in Block 20, if different from Report)

18. SUPPLEMENTARY NOTES

19. KEY WORDS (Continue on reverse side if necessary and identify by block number)

Intelligence indications
Intelligence analysis
Tactical intelligence

20. ABSTRACT (Continue on reverse side if necessary and identify by block number)

As part of an effort to provide improved techniques and methods for planning the collection and analysis of intelligence information, an experiment was replicated which showed that tactical intelligence indications, as currently used, are of doubtful effectiveness. In the present experiment, 28 intelligence specialists (primarily from the 163d Military Intelligence Battalion) each assumed the role of an intelligence analyst in a G-2 section of an infantry division conducting a mobile defense in north central West Germany. Each individual estimated the probability that each of the 49

next page (1)

DD FORM 1 JAN 73 1473 EDITION OF 1 NOV 65 IS OBSOLETE

408020

Unclassified

SECURITY CLASSIFICATION OF THIS PAGE (When Data Entered)

20. indications of conventional military operations listed in Field Manual 30-5, Combat Intelligence, would occur, given a known aggressor course of action. Each indication was evaluated with four separate enemy courses of action - Attack, Defend, Delay, and Withdraw. Eleven indications were evaluated twice with each course of action to provide an estimate of reliability. The previous experiment had used the same procedure with 44 students in the Intelligence Officers Advanced Course. In both experiments, individual estimates were highly reliable. However, variability in the estimates made by different individuals for the same indication was extremely high (greater than .7 on a 0 - 1.0 scale in both experiments). Only 12 indications were perceived by this group and 19 by the previous group as effective discriminators of the course of action with which they are doctrinally associated. Estimates made by officers and enlisted men in the present experiment did not differ significantly, nor did estimates made by intelligence specialists in the present research differ significantly from those made by student officers previously. Findings confirmed that current indications of conventional military operations are either poorly understood or intrinsically inadequate for use in contemporary intelligence operations, or both.

Both experiments were conducted as part of the Intelligence Information Processing Program of the U.S. Army Research Institute for the Behavioral and Social Sciences.

Technical Paper 282

THE PERCEPTION OF TACTICAL INTELLIGENCE INDICATIONS: A REPLICATION

Edgar M. Johnson

BATTLEFIELD INFORMATION SYSTEMS TECHNICAL AREA
Robert S. Andrews, Chief

Submitted By:
Joseph Zeidner, Director
ORGANIZATIONS & SYSTEMS
RESEARCH LABORATORY

Approved By:
J. E. Uhlaner
TECHNICAL DIRECTOR

U.S. ARMY RESEARCH INSTITUTE FOR THE BEHAVIORAL AND SOCIAL SCIENCES
5001 Eisenhower Avenue, Alexandria, Virginia 22333

Office, Deputy Chief of Staff for Personnel
Department of the Army

September 1977

Army Project Number
20062101A754

Intelligence Systems

(3)

ARI Research Reports and Technical Papers are intended for sponsors of R&D tasks and other research and military agencies. Any findings ready for implementation at the time of publication are presented in the latter part of the Brief. Upon completion of a major phase of the task, formal recommendations for official action normally are conveyed to appropriate military agencies by briefing or Disposition Form.

FOREWORD

The Battlefield Information Systems Technical Area of the U.S. Army Research Institute for the Behavioral and Social Sciences (ARI) does research on tactical information systems - the transformation and organization of battlefield information, and staff aids to battle management in target acquisition, intelligence, and command/control systems - as well as information system resource management, using automated tactical data systems, and the investigation of the kinds of perceptions and thinking necessary for the proper judging of tactical intelligence information. ARI Technical Paper 278 assessed the usefulness of traditional tactical intelligence indications as identified and interpreted by students in the Intelligence Officers Advanced Course; the present report describes a replication of the assessment with experienced intelligence specialists from the 163d Military Intelligence Battalion.

The research was done in response to requirements of Army Project 20062101A754 and to special requirements of the Combined Arms Combat Development Activity (CACDA), Fort Leavenworth, KS.

J. E. UHLANER
Technical Director

(5)
(6) Blank

THE PERCEPTION OF TACTICAL INTELLIGENCE INDICATIONS: A REPLICATION

BRIEF

Requirement:

To reassess findings from previous research that brought into question the effectiveness of "indications" as used in the tactical intelligence cycle.

Procedure:

In the present experiment, participants were 28 intelligence specialists (officers and enlisted men), 27 from the 163d Military Intelligence Battalion and 1 from Project MASSTER.

Each specialist assumed the role of an intelligence staff analyst in the G-2 section of an Infantry Division conducting a mobile defense in north-central West Germany. Each individual estimated the probability that each of the 49 indications of conventional military operations listed in FM 30-5, Combat Intelligence, would occur, given the aggressor's known course of action.

Each indication was evaluated with four separate courses of action - Attack, Defend, Delay, and Withdraw. Eleven indications were evaluated twice with each course of action to provide an estimate of reliability. The previous experiment had used the same procedure with 44 captains enrolled in the Intelligence Officers Advanced Course at the U.S. Army Intelligence Center and School, Fort Huachuca, AZ.

Findings:

In both experiments, the estimates made by individuals were highly reliable. The variability in the estimates made by different individuals for the same indication was extremely high, with an average range of estimates greater than .7 on a 0 to 1.0 scale.

Only 12 indications out of 49 were perceived by this group, and only 19 by the previous group, as effective discriminators of the enemy course of action with which they are doctrinally associated.

There were no significant differences between estimates made by officers and by enlisted personnel.

There were no significant differences in the estimates made by the intelligence specialists (officers and enlisted men) of the 163d and the estimates made previously by officers in the Intelligence Officers Advanced Course.

Utilization of Findings:

These findings confirmed the conclusion of the previous research that traditional indications of conventional military operations are either poorly understood or intrinsically inadequate for use in contemporary intelligence operations, or both. Accordingly, intelligence personnel should be extremely cautious in the use or interpretation of current indications.

Development of a user-oriented indications structure could improve the identification and utilization of indications. Two possible approaches to such a structure are based on the Delphi procedure of pooled expertise and on operational gaming.

THE PERCEPTION OF TACTICAL INTELLIGENCE INDICATIONS: A REPLICATION

TABLE OF CONTENTS

THE PERCEPTION OF TACTICAL INTELLIGENCE INDICATIONS: A REPLICATION

INTRODUCTION

It is virtually impossible for a military force to conduct operations without some telltale activities. Identification and interpretation of specific activities of a military force which are typically associated with specific courses of action - indications - are critical tasks in the tactical intelligence cycle.

Intelligence information is organized around indications in the production of intelligence; analysis of indications is the basis for estimating aggressor capabilities and vulnerabilities.

Intelligence requirements are analyzed in terms of indications which, by their existence or nonexistence, provide an answer to the requirement. Indications also provide the basis for specific orders and requests for information. Thus, indications are a focal point for both the intelligence collection manager and the intelligence analyst in relating specific information to intelligence questions (Figure 1). Recent research (Johnson, Spooner, and Jaarsma, 1977)* suggests that current indications of conventional military operations may be inadequate for use in contemporary intelligence operations.

An indication is formally defined as:

> ". . . any positive or negative evidence of enemy activity or any characteristic of the area of operations which points toward enemy vulnerabilities or the adoption or rejection by the enemy of a particular capability, or which may influence the commander's selection of a particular course of action."**

Conditions which result from either previous actions or enemy failure to take action may be indications. Indications are neither abstract events nor specific data items. Rather, indications are patterns of specific events or activities that are consequences of conducting military operations.

One such pattern is the forward deployment of supply and evacuation installations in preparing to attack.

---

* Johnson, E. M., Spooner, R. L. and Jaarsma, D. The Perception of Tactical Intelligence Indications by Intelligence Officers. ARI Technical Paper 278, 1977.

** Department of the Army Field Manual, FM 30-5, Combat Intelligence. October 1973.

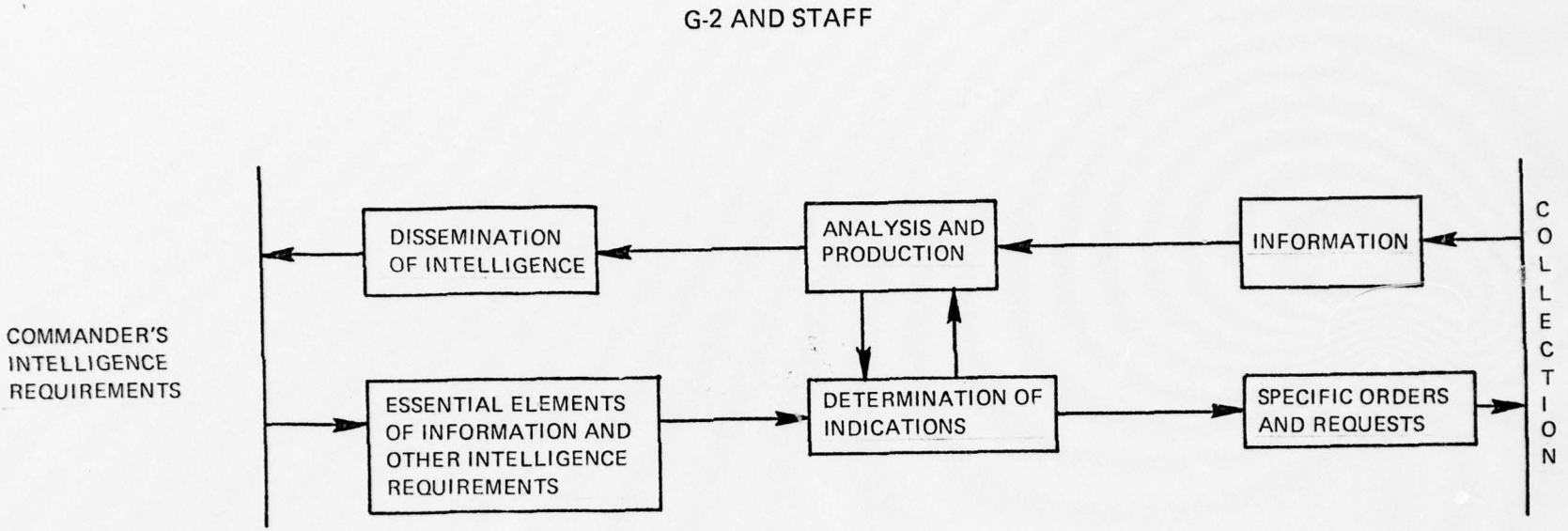


Figure 1. The Role Of Indications In Combat Intelligence

Indications are probabilistic in nature; they represent patterns of activity which may occur whenever the enemy is engaged in a specific course of action.

The extent to which an indication is an effective discriminator among alternative courses of action depends on differences in the relative frequency of occurrence of an indication with each of the possible courses of action.

For example, an enemy may have deployed his combat elements in echelon on 10% of the occasions on which he did not attack and on 80% of the occasions when he did attack. This activity then provides an indication that is highly predictive on an attack.

However, if an enemy had deployed his combat elements in echelon in 70% of the occasions when he did not attack, this activity would not be very predictive of the enemy's course of action.

Current tactical intelligence indications were developed by the U.S. Army in the post-World War II period. These indications are organized around four general courses of action - Attack, Defend, Delay, and Withdraw (Table 1) and emphasize conventional infantry, armor, and artillery activity (FM 30-5, op cit; FM 30-102, 1969)*

Activities associated with the use of nuclear weapons and tactical air have since been treated as special cases. These traditional indications are based on lessons learned in World War II and represent a sampling of typical indications.

The set is by no means complete, nor is it intended for dogmatic application in all situations, but rather as a guideline to provide a base from which intelligence personnel can develop indications appropriate to a specific situation.

Traditional indications are extensively used for instructional purposes in tactical intelligence courses and in field exercises and war games. The traditional indications have been criticized by intelligence personnel as being too generalized in nature for most tactical situations and too specialized as to type of conflict.

Many intelligence officers consider that the indications are dated and bear little relationship to contemporary conflict. Any evaluation of the traditional indications must be based in part on military judgment. In fact, an initial evaluation could be based solely on the judgment of intelligence personnel.

---

*Department of the Army Field Manual, FM 30-102, Handbook on Aggressor Military Forces. October 1969.

Table 1. Mean and Range of Perceived Probability of Occurrence of Standard Intelligence Indications Estimated by Personnel from the 163d Military Intelligence Battalion
(Page 1 of 8)

Indications	Given Aggressor Course of Action: Attack	Defend	Delay	Withdraw
Attack				
1.* Massing of mechanized elements, tanks, artillery, and logistical support	82 (50-100)	37 (0-100)	35 (0-100)	24 (0-90)
2. Deployment of combat elements (mechanized, armor, antitank) in echelon	63 (0-100)	60 (10-90)	57 (10-100)	36 (10-100)
3. Dispersal of tanks and SP guns to forward units	64 (0-100)	61 (10-100)	50 (0-100)	28 (0-100)
4.* Extensive artillery preparation	79 (10-100)	53 (0-100)	44 (0-100)	34 (0-80)
5.* Artillery positions well forward and concentrated	84 (40-100)	34 (0-100)	31 (0-100)	16 (0-50)
6. Medium antiaircraft guns located in forward areas	66 (30-100)	65 (10-100)	53 (0-100)	37 (0-80)

*The mean perceived probability of occurrence is significantly higher given the course of action with which the indication is doctrinally associated than given any of the remaining three courses of action.

Table 1 (page 2 of 8)

Indications	Given Aggressor Course of Action: Attack	Defend	Delay	Withdraw
Attack				
7. Forward units disposed on relatively narrow fronts	70 (0-100)	45 (0-100)	38 (0-100)	28 (0-90)
8.* Concentration of mass toward either or both flanks	68 (0-100)	33 (0-100)	34 (0-80)	25 (0-70)
9. Establishment and strengthening of counterreconnaissance screen	66 (20-100)	68 (20-100)	60 (30-90)	59 (10-100)
10.* Location of enemy troops in forward assembly areas	81 (30-100)	36 (0-100)	29 (0-100)	22 (0-50)
11. Increased activity in rear areas	70 (40-100)	43 (0-100)	53 (20-100)	58 (1-100)
12.* Location of supply and evacuation installations well forward	76 (40-100)	40 (0-100)	25 (0-100)	16 (0-80)

*The mean perceived probability of occurrence is significantly higher given the course of action with which the indication is doctrinally associated than given any of the remaining three courses of action.

(15) 5

Table 1 (page 3 of 8)

Indications	Given Aggressor Course of Action: Attack	Defend	Delay	Withdraw
Attack				
13. Increased patrolling	76 (40-100)	56 (10-100)	39 (0-90)	26 (0-80)
14.* Increased air reconnaissance	76 (30-100)	49 (10-100)	42 (10-100)	38 (0-90)
15. Systematic air bombardment	74 (20-100)	45 (0-100)	49 (10-100)	50 (10-100)
16. Increase in fighter aircraft over battle area	74 (50-100)	44 (10-100)	55 (0-100)	45 (10-90)
17. Increased sensor reconnaissance activity	66 (10-100)	58 (10-100)	53 (0-100)	39 (0-100)
18. Clearing lanes through obstacles within own position	68 (10-100)	34 (0-100)	45 (0-100)	53 (0-100)

*The mean perceived probability of occurrence is significantly higher given the course of action with which the indication is doctrinally associated than given any of the remaining three courses of action.

Table 1 (page 4 of 8)

Indications	Given Aggressor Course of Action: Attack	Defend	Delay	Withdraw
Attack				
19. Sudden increase in communications security measures	76 (10-100)	41 (0-100)	49 (20-90)	55 (0-100)
20.* Reconnaissance and destruction of obstacles that are part of enemy defenses	68 (0-100)	21 (0-50)	33 (0-100)	28 (0-100)
21.* Movement of additional troops toward the front	82 (50-100)	48 (10-100)	35 (0-100)	16 (0-50)
22. Increased vehicle traffic toward present position	72 (20-100)	53 (20-100)	34 (0-80)	31 (0-100)
23.* Conducting drills and rehearsals in rear areas	77 (20-100)	24 (0-80)	22 (0-70)	17 (0-70)

*The mean perceived probability of occurrence is significantly higher given the course of action with which the indication is doctrinally associated than given any of the remaining three courses of action.

Table 1 (page 5 of 8)

Indications	Given Aggressor Course of Action: Attack	Defend	Delay	Withdraw
Attack				
24. Demonstrations and feints	62 (20-100)	45 (0-100)	48 (0-100)	45 (0-90)
25.* Identification of new units in combat zone	70 (20-100)	44 (0-100)	31 (0-100)	23 (0-70)
26. Additional command posts and supply and evacuation installations	69 (10-100)	50 (10-100)	63 (10-100)	41 (0-90)
27. Light aircraft circling over moving convoy	48 (0-100)	43 (10-100)	35 (0-90)	41 (0-100)
28. Movement of small groups of heavily armed helicopters escorted by tactical fighters	68 (30-100)	38 (0-100)	47 (0-100)	33 (0-100)
29. Incresed or unusual air activity	70 (30-100)	45 (0-100)	44 (0-90)	43 (0-90)
30. Sudden increase in communication and electronic activities	66 (0-100)	37 (0-90)	46 (10-100)	47 (10-100)

*The mean perceived probability of occurrence is significantly higher given the course of action with which the indication is doctrinally associated than given any of the remaining three courses of action.

Table 1 (page 6 of 8)

Indications	Given Aggressor Course of Action: Attack	Defend	Delay	Withdraw
Defend				
31. Withdrawal from defensive position before becoming heavily engaged	23 (0-80)	29 (0-100)	76 (0-100)	78 (0-100)
32. Successive local counterattacks with limited objectives	46 (0-90)	57 (20-100)	59 (0-100)	46 (10-90)
33. Counterattacks broken off before position is restored	25 (0-80)	39 (0-100)	60 (0-100)	54 (0-100)
34. Preparation of battalion and company defensive areas	27 (0-100)	80 (20-100)	60 (20-100)	37 (0-80)
35.* Extensive preparation of field fortifications	25 (0-100)	86 (50-100)	49 (0-100)	33 (0-80)
36. Formation of antitank strongpoints	27 (0-80)	80 (40-100)	67 (30-100)	60 (0-100)

*The mean perceived probability of occurrence is significantly higher given the course of action with which the indication is doctrinally associated than given any of the remaining three courses of action.

(19)

Table 1 (page 7 of 8)

Indications	Given Aggressor Course of Action: Attack	Defend	Delay	Withdraw
Defend				
37. Preparation of alternate artillery positions	48 (10-100)	65 (20-100)	73 (20-100)	65 (0-100)
38. Preparation and occupation of successive defense lines	27 (0-100)	73 (20-100)	81 (40-100)	61 (0-100)
39. Presence of demolitions, contaminated areas, obstacles, and minefields	25 (0-80)	79 (10-100)	74 (30-100)	68 (10-100)
40. Dumping ammunition and engineer supplies and equipment and fortifying buildings	33 (0-100)	69 (0-100)	48 (0-100)	33 (0-100)
41. Entrenching and erecting bands of wire	25 (0-100)	79 (40-100)	56 (0-100)	41 (0-80)
42. Deployment of mechanized units on good defensive terrain	31 (0-100)	78 (30-100)	75 (20-100)	49 (0-100)

Indications	Given Aggressor Course of Action: Attack	Defend	Delay	Withdraw
Defend				
43. Employment of roving artillery	46 (0-100)	57 (10-100)	60 (0-100)	50 (10-100)
44. Attachment of additional antitank units to frontline defensive positions	50 (10-100)	78 (10-100)	64 (20-100)	46 (0-90)
45. Large tank units located in assembly areas to the rear	65 (10-100)	47 (0-100)	41 (0-90)	43 (0-100)
Delay				
46. Maximum firepower positioned forward; firing initiated at long ranges	75 (20-100)	49 (0-100)	46 (0-100)	26 (0-90)
47. Rearward movement of long-range artillery and supply echelons	17 (0-90)	49 (0-100)	68 (20-100)	84 (40-100)
48. Frontages up to four times that normally assigned to units on the defensive	23 (0-100)	28 (0-100)	61 (0-100)	64 (0-100)
Withdraw				
49. Systematic destruction of bridges, communication facilities, and other military assets in enemy territory	35 (0-100)	26 (0-100)	54 (0-90)	74 (10-100)

An experiment designed to yield such an initial evaluation of the effectiveness of traditional indications was recently conducted in terms of the probability of occurrence of specific indications as perceived by intelligence officers (Johnson, Spooner, and Jaarsma, op. cit).

In that experiment, 44 captains in the Intelligence Officers Advanced Course each assumed the role of staff officer in the G-2 section of the 20th U.S. Infantry Division conducting a mobile defense in north-central West Germany.

Each officer estimated the probability of occurrence of each of the 49 indications of conventional military operations listed in FM 30-5, given a known aggressor course of action. Each indication was evaluated with four separate courses of action - Attack, Defend, Delay, and Withdraw.

Eleven indications were evaluated twice with each course of action to provide an estimate of reliability. The estimates made by each officer were highly reliable. However, the variability in the estimates made by different officers for the same indication was extremely high, with an average range of estimates greater than .7 on a 0 to 1.0 scale.

At most, 19 of the 49 indications were perceived as effective discriminators of the course of action with which they are doctrinally associated. Further, the logic underlying clusters of related indications could not be clearly identified for any of the four courses of action.

The experiment summarized above raised serious doubts as to the adequacy of current tactical intelligence indications and suggested that criticisms by intelligence personnel are valid. Several possible explanations were suggested to account for the results:

1. The variability in the perceived probability of occurrence of the indications accurately reflects their relationship with the alternative courses of action, and the indications are intrinsically inadequate.

2. The indications are effective discriminators between alternative courses of action, but the officers did not possess the requisite knowledge to evaluate the indications.

3. It is not feasible to evaluate indications in the context of a brief description of the situation, and doctrine concerning the generality of indications is misleading.

4. It is not feasible to evaluate indications singly, and the only doctrinal basis for grouping indications - in terms of the four courses of action - is inadequate.

Which of these explanations, or combination of explanations, accounted for the results of Johnson, Spooner, and Jaarsma could not be determined from the data.

A fifth possible explanation of the data, however, is that all the intelligence officers serving as subjects were not oriented toward tactical intelligence. Many military intelligence officers, although familiar with tactical intelligence, are primarily trained and experienced in other, different areas of intelligence, e.g., counterintelligence.

Intelligence personnel trained in, and assigned to, tactical intelligence positions may perceive the current tactical intelligence indications differently than the "average" intelligence officer. This alternative explanation could be evaluated by replicating the previous experiment using only tactical intelligence personnel.

Such a sample of tactical intelligence personnel was made available through the cooperation of Project MASSTER (Modern Army Selected Systems Test Evaluation and Review)* and the 163d Military Intelligence Battalion stationed at Fort Hood, TX.

The specific objective of the present replication was to compare the perception of tactical intelligence indications by personnel from the 163d Military Intelligence Battalion with data previously obtained from students in the Intelligence Officers Advanced Course.

METHOD

Sample

Participating in the experiment were 28 intelligence specialists stationed at Fort Hood, TX. One was from Project MASSTER, Experimental Task, and the other 27 were members of the 163d Military Intelligence Battalion.

Each participant was asked to assume the role of an intelligence staff analyst in the G-2 section of the 20th U.S. Infantry Division conducting a mobile defense in north-central West Germany near the east/west German border.

In the context of the scenario described below, participants estimated the probability that each of 49 indications would occur, given a known aggressor course of action. Each indication was evaluated relative to four enemy courses of action - Attack, Defend, Delay, Withdraw.

---

*Now TCATA (TRADOC Combined Army Test Activity).

Scenario. A brief scenario was presented in which each of four courses of action was feasible for the Aggressor. Following a coordinated non-nuclear attack into West Germany in July, NATO forces had blunted the attack, and the front had become relatively stable by 15 August.

The Aggressor's main penetration was north of the Sauerland. South and east of the Sauerland, NATO forces were in defensive positions east of the Vogelsberg. As of 15 September, the G-2 Intelligence Estimate listed the following Aggressor capabilities:

1. Continue defense along the border area.

2. Attack at any time along the border.

3. Withdraw major elements of the 2nd CAA to support operations in the North.

4. Conduct delaying operations along the border while main elements move to defensive positions.

Indications. From FM 30-102, 49 indications descriptive of enemy activity were selected. These 49 included all indications relating to mid-intensity non-nuclear conflict, as well as indications of nuclear operations related to non-nuclear operations.

By doctrine, 30 of the 49 indications are related to Attack, 15 to Defend, 3 to Delay and 1 to Withdraw. Two indications of Reinforcement and four of Nuclear operations are included in the 30 Attack indications.

Procedure

A response booklet was prepared which included the scenario, instructions, and lists of indications. This booklet was identical with the response booklet used in the previous experiment. For each course of action, four different pages of 15 indications each were prepared. Eleven indications were listed twice with each course of action.

The 60 indications were listed in random order for each couse of action. However, an indication was never listed twice on the same page. The four pages of indications for each Aggressor course of action were assembled in one of 24 possible orderings.

Thus, each subject evaluated all of the indications relative to one course of action before proceeding to evaluate the indications given another course of action. The four-page sets of indications for each of the four Aggressor courses of action were assembled in one of 24 possible orderings.

(24)

There were 576 possible unique orderings of indications and courses of action in the response booklets. Each subject evaluated the 16 pages of indications in a different order.

The experiment was conducted in a single session in a large conference room. After the response booklets were handed out, an overview of the experiment was read, and subjects were allowed 10 minutes to become familiar with the scenario. They were then instructed that

> . . .Your task on the 16 pages of the Indications section is to evaluate for each indication listed the probability that it will occur, given the Aggressor <u>is</u> taking the specific course of action listed at the top of the page. These evaluations are to be made in the context of the Meiningen Gap Scenario given in the previous section. You should not concern yourself with the specific details of the scenario. Rather, you should consider it as a general framework within which to make your evaluations.
>
> The way you should think of your assessment is as a <u>probability of occurrence</u>. Since probabilities range from 0 to 1, this is the range of assignments you may use to describe your judgment. This may be confusing so let's look at a similar type of judgment - weather predicting . . .

Subjects were instructed to evaluate each indication independently of any other indication, considering only the Aggressor's true course of action, to complete each page before continuing to the following page, and not to refer back to a page once it had been completed. It was stressed that accuracy was more important than speed.* Breaks were allowed as required. Subjects required 40 to 75 minutes to complete the task and to complete an experience questionnaire.

---

* Other methods are available for eliciting more "precise" subjective probability estimates (Huber, G. P. Methods For Quantifying Subjective Probabilities and Multi-Attribute Utilities. <u>Decision Sciences</u>, 1974, <u>5</u>, 430-458). These methods all require that a consultant work directly with the individual making the estimate. Thus, although not appropriate for the present study, the methods would be appropriate in developing baseline data.

RESULTS

The basic data were the probabilities of occurrence assigned by each subject to each indication, given each of the four courses of action. Of principal interest was a comparison of the perception of indications by the intelligence specialists of the 163d with data previously collected from officers in the Intelligence Officers Advanced Course.

The subjects in the two groups are described below. The first question considered was the reliability of the estimates provided by the subjects. Analyses of two types are then presented:

One focuses on differences among specific indications considering only the subjects in the present experiment, while the other focuses on differences between the two groups of subjects - intelligence specialists and students in the Intelligence Officers Advanced Course.

Subject Profile

Two of the 28 subjects in the present experiments did not complete the post-experiment questionnaire. The profile therefore is based on 26 subjects. There were 13 officers (one O-1, four O-2s, six O-3s, and two O-5s) and 13 enlisted men (two E-2s, one E-4, six E-6s, four E-7s, and one E-8).

The officers had 1 to 19 years of active duty; the average was 7.5 years. The enlisted men had 8 months to 20 years of active duty; the average was 9.6 years. Primary Military Occupational Specialties (PMOS) among the officers were distributed as follows:

> Eight Tactical Intelligence Staff Officers (PMOS 9301) with six months to three years' experience; the average was 1.7 years.
>
> Two Counterintelligence Officers (PMOS 9666), each with two years' experience. One of these officers had 12 previous years' experience as a Tactical Intelligence Staff Officer.
>
> Two Strategic Intelligence Staff Officers (PMOS 9300), one with one and the other with six years' experience. One of these officers had four previous years' experience as a Tactical Intelligence Staff Officer.
>
> One Aerial Surveillance Officer (PMOS 9309) with seven years' experience.

All the enlisted personnel were Intelligence/Order of Battle Analysts (PMOS 96B) with three months to 20 years' experience; the average experience in intelligence was 5.4 years.

The subjects considered themselves familiar with indications, and most (20 of the 26) said that they had used the standard intelligence indications in operational settings, field exercises, or both.

These subjects represent a much more skilled and experienced group of tactical intelligence personnel than those in the previous research. All 44 students in the original experiment were captains with 1 to 11 years of active duty; the average was 6.3 years.

Primary Military Occupational Specialties were varied, with only two PMOS represented by 5 or more students; 17 were Counterintelligence Officers (PMOS 9666) and 6 were Tactical Intelligence Staff Officers (PMOS 9301). The students were in the fifth month of the Intelligence Officers Advanced Course and had recently received the block of instruction concerning collection planning and the use of indications.

Post-experiment questionnaires showed that the students considered themselves familiar with indications. However, most had never used indications in an operational setting.

Response Reliability

The 11 indications presented twice with each given course of action were pooled over the four courses of action to provide a total of 44 repeated estimates by each subject. The mean intrasubject product-moment correlation for the 28 subjects was .79, with a range of .42 to .97 and a standard deviation of .12.

These coefficients reveal that subjects were quite consistent in their perceptions of the probability of occurrence of specific indications. Subsequent analyses used the mean of a subject's two responses for each of the 11 indications repeated within a given course of action.

For subjects in the previous experiment, the mean intrasubject product-moment correlation was .77, with a range of .39 to .97 and a standard deviation of .13. The small difference between the groups in mean correlation is not significant.

Differences among Indications - Intelligence Specialists

The mean and range of the perceived probability of occurrence of each indication for each course of action are presented in Table 1. (The corresponding standard deviations averaged 23.4, varying from 12.3 to 34.3*).

All indications had a non-zero mean perceived probability of occurrence with each of the four courses of action. That is, all indications were perceived as feasible, given any of the four courses of action. The intersubject variability of the estimates was extremely high, with an average range of 87.9.

Note that the subjects did not use the fine-grain feature of the 100-point scale in making their judgments. All but one, of more than 5,000 separate assessments by the 28 individuals, was made in multiples of 10, i.e., 20, 30, etc.

An analysis of variance of indications x courses of action revealed significant differences between courses of action ($F(3,81) = 27.2$, $p < .001$), indications ($F(48,1296) = 9.69$ $p < .001$), and a significant interaction of indications x courses of action ($F(144,3888) = 19.58$, $p < .001$).

Comparisons among the four courses of action averaged over the 49 indications are not very useful. Neither are comparisons among the 49 indications averaged over the four courses of action. Rather, the comparisons of interest concern the interaction among courses of action for a given indication.

Results of the comparisons using the Tukey (b) procedure (Winer, 1962**) at a .01 level of significance are shown in Table 1. Entries underlined by a common line do not differ significantly from each other; entries not so underlined do differ significantly.

Using indication Number 1 as an example, the mean perceived probability of occurrence was significantly higher given Attack than given either Defend, Delay, or Withdraw. The mean perceived probability of occurrence was not significantly different when given either Defend, Delay, or Withdraw.

---

* Previous data from the 44 students on the mean and range of the perceived probability of occurrence of each indication for each course of action are presented in Table 2. (The corresponding standard deviations averaged 20.4, varying between 11.8 and 26.0).

** Winer, B. J. Statistical Principles in Experimental Design. New York: McGraw-Hill, 1962.

For a few indications, the pattern of significant differences may not be immediately clear. The complexity results from listing the courses of action in a standard order, rather than in terms of an ascending or descending order of mean perceived probability of occurrence.

The pattern of significant differences becomes apparent if the mean perceived probability of occurrence associated with each course of action is listed in a descending order as shown below for indication Number 16.

Attack	Delay	Withdraw	Defend
74	55	45	44

The mean perceived probability of occurrence was not significantly different between the Aggressor courses of action of Attack and Delay, or among Delay, Withdraw, and Defend. However, the indication was perceived as significantly more probable if the Aggressor course of action was Attack than if the Aggressor course of action was Withdraw or Defend.

Results of the comparisons shown in Table 1 can be summarized as follows:

1. For 14 of the 49 indications (11 Attack and 3 Defend) there were no significant differences in the mean perceived probability of occurrence among the four courses of action.

2. Eleven of the 30 indications doctrinally associated with Attack had significantly higher mean perceived probabilities of occurrence given Attack than given any of the remaining three courses of action. These indications are identified by an asterisk (*) in Table 1.

3. One of the 15 indications doctrinally associated with Defend had a significantly higher mean perceived probability of occurrence given Defend than given any of the remaining three courses of action. This indication is also identified by an asterisk (*) in Table 1.

4. Neither the three indications doctrinally associated with Delay nor the indication of Withdraw had significantly higher mean perceived probabilities of occurrence given Delay or Withdraw, respectively.

Results of the comparison tests imply that traditional indications are not good discriminators among the four courses of action. Only 12 of the 49 indications (11 Attack and 1 Defend) had a significantly higher mean perceived probability of occurrence given the course of action with which they are doctrinally associated.

Considering only these 12 indications, given the doctrinal course of action, the perceived probability of occurrence had a range of at least .50, and a mean perceived probability of occurrence of at least .16 with some other course of action. Thus, given an estimate from an individual using one of these 12 "good" indications, the Aggressor's course of action is still somewhat ambiguous.

One possible source of variation in this sample is the differential training, experience, and interests between officers and enlisted personnel. This factor was evaluated using the 26 subjects who completed the post-experiment questionnaire.

An analysis of variance of type of personnel x indications x courses of action revealed no significant differences between the 13 officers and the 13 enlisted personnel ($F(1,24) = 2.3665$), nor any significant interactions with type of personnel.

Comparison Between Students in the Intelligence Officers Advanced Course and Intelligence Specialists (officers and enlisted men) of the 163d

Individuals in both groups were highly consistent in their own perceptions of the probability of occurrence of specific indications. There was no significant difference in the mean individual reliability of estimation between the two groups.

There was a high degree of similarity in the mean and range (and standard deviations) of the perceived probability of occurrence of each indication for each course of action between the two groups (Table 1 and Table 2.

An analysis of variance* of subject group x indications x course of action revealed no significant main effect of subject groups ($F(1,70) = .6$). However, there were two significant interactions with subject group: subject group x indications ($F(48,3260) = 10.91$) and subject group x indications x course of action ($F(144, 10080) = 24.19$). As discussed previously, comparisons between groups for each indication averaged over the four courses of action would not be very useful. Comparison between groups for each indication with each course of action were made using Tukey (b) procedure at a .01 level of significance.

Of the 196 possible between-group comparisons for each indication with each course of action, only 15 were significant. There appeared to be no pattern to the differences between groups (Tables 1 and 2).

---

*An unweighted-means solution was used in view of the unequal number of subjects in the two groups (Winer, 1962, op.cit).

Table 2. Mean and Range of Perceived Probability of Occurrence of Standard Intelligence Indications Estimated by 44 Students in the Intelligence Officers Advanced Course
(Page 1 of 8)

Indications	Given Aggressor Course of Action: Attack	Defend	Delay	Withdraw
Attack				
1.* Massing of mechanized elements, tanks, artillery, and logistical support	75 (20-100)	49 (0-100)	32 (0-90)	33 (0-90)
2.* Deployment of combat elements (mechanized, armor, antitank) in echelon	73 (10-90)	43 (10-90)	38 (0-90)	30 (0-80)
3. Dispersal of tanks and SP guns to forward units	73 (20-90)	54 (0-100)	46 (10-90)	27 (2-80)
4.* Extensive artillery preparation	80 (30-100)	39 (0-100)	31 (0-80)	30 (0-90)
5.* Artillery positions well forward and concentrated	79 (20-100)	30 (0-90)	24 (0-80)	14 (0-50)
6. Medium antiaircraft guns located in forward areas	63 (20-90)	62 (10-90)	49 (10-90)	33 (10-70)

*(From Johnson, Spooner, and Jaarsma, 1977).

Table 2 (page 2 of 8)

Indications	Given Aggressor Course of Action: Attack	Defend	Delay	Withdraw
Attack				
7. Forward units disposed on relatively narrow fronts	59 (10-100)	39 (0-80)	36 (0-80)	36 (0-80)
8.* Concentration of mass toward either or both flanks	65 (20-95)	38 (0-70)	35 (0-90)	31 (0-70)
9. Establishment and strengthening of counterreconnaissance screen	67 (10-90)	71 (30-90)	56 (10-90)	56 (10-90)
10.* Location of enemy troops in forward assembly areas	79 (50-95)	30 (0-90)	33 (0-90)	24 (0-90)
11. Increased activity in rear areas	62 (20-90)	49 (10-90)	58 (10-95)	61 (0-90)
12. Location of supply and evacuation installations well forward	78 (50-100)	35 (0-90)	22 (0-90)	18 (0-90)
13. Increased patrolling	73 (20-90)	50 (0-90)	43 (0-90)	33 (0-90)

*(From Johnson, Spooner, and Jaarsma, 1977).

Table 2 (page 3 of 8)

Indications	Given Aggressor Course of Action: Attack	Defend	Delay	Withdraw
Attack				
14.* Increased air reconnaissance	76 (50-100)	45 (0-97)	43 (0-90)	35 (10-80)
15.* Systematic air bombardment	68 (10-100)	42 (5-90)	43 (0-90)	39 (0-90)
16.* Increase in fighter aircraft over battle area	75 (30-100)	44 (10-80)	40 (10-80)	39 (10-80)
17. Increased sensor reconnaissance activity	62 (10-90)	64 (0-90)	54 (0-90)	42 (0-80)
18. Clearing lanes through obstacles within own position	73 (30-100)	30 (0-90)	43 (0-90)	51 (0-90)
19. Sudden increase in communications security measures	70 (10-90)	52 (10-95)	48 (10-91)	55 (10-90)

*(From Johnson, Spooner, and Jaarsma, 1977).

Table 2 (page 4 of 8)

Indications	Given Aggressor Course of Action: Attack	Defend	Delay	Withdraw
Attack				
20.* Reconnaissance and destruction of obstacles that are part of enemy defenses	66 (10-100)	24 (0-90)	24 (0-90)	30 (0-90)
21.* Movement of additional troops toward the front	80 (30-100)	44 (0-90)	32 (0-90)	15 (0-70)
22. Increased vehicle traffic toward present position	71 (30-90)	50 (0-90)	35 (10-80)	28 (10-80)
23.* Conducting drills and rehearsals in rear areas	76 (20-95)	26 (0-90)	30 (0-80)	24 (0-80)
24. Demonstrations and feints	62 (10-90)	39 (0-90)	50 (10-92)	45 (0-90)
25.* Identification of new units in combat zone	71 (20-99)	44 (0-100)	24 (0-60)	18 (0-40)

*(From Johnson, Spooner, and Jaarsma, 1977).

(34)

Table 2 (page 5 of 8)

Indications	Given Aggressor Course of Action: Attack	Defend	Delay	Withdraw
Attack				
26.* Additional command posts and supply and evacuation installations	69 (20-90)	45 (0-90)	48 (10-90)	33 (0-90)
27. Light aircraft circling over moving convoy	51 (10-90)	40 (0-80)	36 (0-90)	33 (0-70)
28.* Movement of small groups of heavily armed helicopters escorted by tactical fighters	67 (20-90)	39 (0-90)	35 (0-90)	34 (10-85)
29.* Increased or unusual air activity	71 (30-90)	43 (5-80)	40 (10-80)	39 (10-78)
30. Sudden increase in communication and electronic activities	73 (40-100)	41 (0-90)	38 (10-90)	50 (10-100)
Defend				
31. Withdrawal from defensive position before becoming heavily engaged	30 (0-80)	27 (0-80)	66 (0-100)	75 (20-100)

*(From Johnson, Spooner, and Jaarsma, 1977).

(35)

Table 2 (page 6 of 8)

Indications	Given Aggressor Course of Action: Attack	Defend	Delay	Withdraw
Defend				
32.* Successive local counterattacks with limited objectives	51 (10-95)	47 (0-90)	62 (0-90)	45 (0-90)
33. Counterattacks broken off before position is restored	34 (0-80)	37 (0-90)	65 (20-90)	56 (0-98)
34.* Preparation of battalion and company defensive areas	28 (0-80)	82 (20-100)	58 (10-90)	36 (10-89)
35.* Extensive preparation of field fortifications	26 (0-90)	84 (20-100)	53 (10-90)	31 (0-90)
36.* Formation of antitank strongpoints	38 (0-80)	78 (40-95)	68 (40-90)	48 (10-90)

*(From Johnson, Spooner, and Jaarsma, 1977).

Table 2 (page 7 of 8)

Indications	Given Aggressor Course of Action: Attack	Defend	Delay	Withdraw
Defend				
37. Preparation of alternate artillery positions	61 (10-100)	59 (10-90)	57 (0-90)	55 (10-90)
38. Preparation and occupation of successive defense lines	28 (0-90)	68 (10-97)	79 (30-100)	67 (20-99)
39. Presence of demolitions, contaminated areas, obstacles, and minefields	27 (0-80)	77 (10-100)	72 (10-90)	66 (20-90)
40. Dumping ammunition and engineer supplies and equipment and fortifying buildings	23 (0-50)	68 (0-100)	46 (10-80)	38 (0-90)
41. Entrenching and erecting bands of wire	27 (0-90)	82 (10-100)	62 (0-90)	39 (10-82)

37

Table 2 (page 8 of 8)

Indications	Given Aggressor Course of Action: Attack	Defend	Delay	Withdraw
Defend				
42. Deployment of mechanized units on good defensive terrain	34 (0-80)	76 (20-100)	64 (10-90)	46 (10-90)
43. Employment of roving artillery	51 (10-90)	52 (0-90)	51 (0-90)	41 (10-80)
44. Attachment of additional antitank units to frontline defensive positions	46 (0-90)	74 (0-100)	62 (30-90)	38 (10-90)
45. Large tank units located in assembly areas to the rear	57 (10-95)	44 (1-90)	45 (0-90)	43 (0-90)
Delay				
46. Maximum firepower positioned forward; firing initiated at long ranges	78 (20-95)	37 (0-100)	38 (0-90)	20 (0-70)
47. Rearward movement of long-range artillery and supply echelons	17 (0-50)	55 (0-100)	63 (20-90)	80 (40-90)

For example, in 8 of 15 significant comparisons, students in the Intelligence Officers Advanced Course assigned a significantly higher mean probability of occurrence than did personnel in the present experiment.

For the remaining seven significant comparisons, students in the Intelligence Officers Advanced Course assigned a significantly lower mean probability of occurrence. Significant interactions involving subject groups appear to result from idiosyncratic rather than systematic differences between groups in the perception of indications.

Correlation among Indications

None of the indications proved unique, nor would one so expect them - the reason indications rarely are used singly. This finding suggests that patterns of intercorrelations between indications may define clusters or groups of related indications associated in a particular way with a given course of action.

In the previous experiment based on students in the Intelligence Officers Advanced Course, principal components factor analysis was used to abstract the underlying or implicit dimensions of variation in the assessments of the indications for each course of action. Two findings emerged from those analyses:

1. Indications were perceived as sets of related events having some overall structure, not as single events or activities.

2. The logic underlying clusters of related indications could not be identified clearly for any of the four courses of action. In view of great similarity between data from the present experiment and data from the previous research on which the above findings were derived, those analyses have not been repeated.

For a more detailed discussion of the previous findings, refer to Johnson, Spooner, and Jaarsma, op. cit.

IMPLICATIONS OF THE RESULTS

The most significant finding of the present replication is the close similarity in the perceived frequency of occurrence of indications between intelligence specialists (officers and enlisted men) of the 163d Military Intelligence Battalion, and officers attending the Intelligence Officers Advanced Course.

Although individual evaluations of a given indication were highly reliable, there was little agreement among individuals concerning the perceived frequency of occurrence of an indication with each of the four courses of action.

Few indications were perceived as effective discriminators of the course of action with which they are doctrinally associated. Thus, the standard indications are likely ineffective, either as the focus of analysis or as the basis for collection planning.

The present experiment represents an initial evaluation of indications based solely on military judgment. The findings derive from the lack of agreement among individuals concerning the perceived frequency of occurrence of an indication, in association with each of the four courses of action, and not from any reference to the validity of specific indications.

Apparently, both the doctrine associated with indications, and the training in identification and use of indications, should be systematically examined and new or remedial methods developed. Further, it is clear that valid doctrine must be available before training can be improved.

The methodology employed in both experiments was based on improved collection planning methods being developed (Jaarsma, Spooner, and Johnson, 1977*). Estimates of the probability of occurrence of an indication, given a known aggressor course of action, are the reverse of the logic normally employed by an analyst.

An analyst usually would estimate the probability of occurrence of an aggressor course of action given a known indication. This "reverse logic" itself did not appear a significant determinant of the results, as individual estimates in both this and the previous experiment were highly reliable.

A more important feature of the methodology is that it was knowledge-based rather than performance-based. That is, individuals were not required to perform an analysis or planning task, but to estimate relationships. A methodology that is performance-based might yield different results.

---

*Jaarsma, D., Spooner, R. L., and Johnson, E. M. Methods for Planning Intelligence Collection: Acquisition Priorities and Resource Allocation. ARI Technical Paper, 1977.

However, findings of this and the previous experiment are so consistent that, rather than develop improved procedures to evaluate traditional indications for use within collection planning or in analysis, it would be better to focus research on improving the identification and utilization of indications.

Such an approach would not only provide a more detailed evaluation of current indications, but would also lead to improved indications and associated doctrine.

Two areas of development, which could improve identification and utilization of indications, were suggested by Johnson, Spooner, and Jaarsma*. One area is development of an improved indications structure; the other is development of baseline data representing the probability of occurrence of specific indications for specific courses of action.

The potential advantages of development in these two areas are numerous. However, both analytic and empirical research is required if indications are to be a generally useful and effective technique in intelligence operations.

The development of an adequate framework or structure for indications must, of necessity, precede the development of baseline data. Two approaches which could be used to develop a user-oriented indications structure are the Delphi technique and operational gaming.

The Delphi procedure (Linstone and Turoff, 1975**) involves the sequential individual questioning (usually by questionnaire) of a set of experts, interspersed with information and opinion feedback derived from earlier parts of the questionnaire program.

The Delphi technique differs from the usual survey or questionnaire in that participants are not identified in succeeding phases, but remain anonymous. A Delphi procedure for indications might begin by attempting to identify specific indications and their associated specific information requirements, within the context of a specific scenario.

The procedure might begin at a specific time in the course of the scenario and examine successive phases of an engagement as agreement among the experts is reached within each phase. A participant in the Delphi would be asked to assume either the role of an intelligence staff analyst or that of the enemy commander.

---

* Ibid.

** Linstone, H. A., and Turoff, M. (Eds.). The Delphi Method: Techniques and Applications. Reading, MA: Addison-Wesley, 1975.

Individuals in the analyst role would attempt to specify what indications might be present and what data would be required to confirm or deny each indication. Individuals in the enemy commander role would attempt to specify the specific actions they would take to pursue certain courses of action and what "traces" would be available from each of these actions.

After each round of questions, responses would be consolidated into a unified response by the experimenters, highlighting areas of both agreement and disagreement among the participants.

This information would be fed back to the participants as part of the next round of questions. This cycle would continue until the participants made no change in response as a result of feedback, and the Delphi would then move to the next phase of the scenario.

Operational gaming (Shubik, 1975*) could be conducted in a similar manner to develop an indications structure, the major exception being that the game actually would be played in accord with all environmental and resource constraints of the military forces in the scenario.

Thus, individuals in the role of an enemy commander would determine which actions would be taken in pursuing a course of action, and individuals in the analyst role would attempt to identify specific actions and their associated data in order to determine the course of action being pursued.

Tabletop or board games would be ideal for use in an analysis of indications, since precise estimates of combat outcomes, although desirable, are not required. This type of game can provide flexible and detailed play in the command, control, and intelligence areas. The game can be stopped at any point to allow analysis by the participants. The procedure is relatively inexpensive.

The objectives of an analysis of indications based on either a Delphi procedure or on operational gaming are similar, although the results obtained would probably differ.

The Delphi has the advantage that the knowledge and expertise of a large number of intelligence and operations experts can be pooled, minimal resources and time are required, and there is little interference with the normal assigned duties of participants.

---

* Shubik, M. Games for Society, Business and War. Amsterdam; Elsevier, 1975.

A Delphi procedure, however, provides no direct method for evaluating its findings. Operational gaming, on the other hand, has the advantage of providing a built-in evaluation as successive phases of the scenario are played.

Operational gaming required more resources than Delphi, would involve fewer experts, and would require a large amount of dedicated time from participants. The two approaches are not mutually exclusive, and one approach would benefit from the results of the other.

A recommended strategy for developing an improved indications structure would be to conduct a Delphi procedure followed by operational gaming. The Delphi could be used to identify specific indications, relationships among indications, and associated data requirements for a scenario of the type used in operational gaming.

The Delphi would provide an initial structure for the operational gaming as well as identify some of the characteristics required in the gaming methodology in order to analyze indications.

Flexible and detailed play in the command, control, and intelligence areas is seldom incorporated in gaming, and having the results of the Delphi before initiating the operational gaming should serve both to simplify the task and to enhance the results of gaming.

This two-fold strategy capitalizes on the unique advantages of both approaches - the Delphi for tapping a large number of experts, and operational gaming for detailed analysis and evaluation.

Once a valid indications structure has been developed, a number of existing techniques can be used to develop baseline data representing probability of occurrence of specific indications as well as relationships between indications for specific courses of action (Huber, 1974, op.cit).

Validity and effectiveness of such baseline information would depend on the quality of the indications structure.

Indications constitute a potentially powerful tool for intelligence personnel. However, extreme caution should be exercised in the use and interpretation of current indications.

There is no easy and simple solution to the problems surfaced by the results of this and the previous experiment. Both analytic and empirical research is required if indications are to be a generally useful and effective technique in intelligence operations.

REFERENCES

Department of the Army Field Manual, FM 30-5, Combat Intelligence.

Department of the Army Field Manual, FM 30-102, Handbook on Aggressor Military Forces.

Huber, G. P. Methods for Quantifying Subjective Probabilities and Multi-Attribute Utilities. Decision Sciences, 1974, 5, 430-458.

Jaarsma, D., Spooner, R. L, and Johnson, E. M. Methods for Planning Intelligence Collection: Acquisition Priorities and Resource Allocation. ARI Technical Paper, 1977.

Johnson, E. M., Spooner, R. L., and Jaarsma, D. The Perception of Tactical Intelligence Indications by Intelligence Officers. ARI Technical Paper 278, December 1976.

Linstone, H. A., and Turoff, M. (Eds.). The Delphi Method: Techniques and Applications. Reading, MA.: Addison-Wesley, 1975.

Shubik, M. Games for Society, Business and War. Amsterdam: Elsevier, 1975.

Winer, B. J. Statistical Principles in Experimental Design. New York: McGraw-Hill, 1962.

REFERENCES

Department of the Army Field Manual, FM 30-5, Combat Intelligence.

Department of the Army Field Manual, FM 30-102, Handbook on Aggressor Military Forces.

Huber, G. P. Methods for Quantifying Subjective Probabilities and Multi-Attribute Utilities. Decision Sciences, 1974, 5, 430-458.

Jaarsma, D., Spooner, R. L, and Johnson, E. M. Methods for Planning Intelligence Collection: Acquisition Priorities and Resource Allocation. ARI Technical Paper, 1977.

Johnson, E. M., Spooner, R. L., and Jaarsma, D. The Perception of Tactical Intelligence Indications by Intelligence Officers. ARI Technical Paper 278, December 1976.

Linstone, H. A., and Turoff, M. (Eds.). The Delphi Method: Techniques and Applications. Reading, MA.: Addison-Wesley, 1975.

Shubik, M. Games for Society, Business and War. Amsterdam: Elsevier, 1975.

Winer, B. J. Statistical Principles in Experimental Design. New York: McGraw-Hill, 1962.

DISTRIBUTION

ARI Distribution List

4 OASD (M&RA)
2 HQDA (DAMI-CSZ)
1 HQDA (DAPE-PBR
1 HQDA (DAMA-AR)
1 HQDA (DAPE-HRE-PO)
1 HQDA (SGRD-ID)
1 HQDA (DAMI-DOT-C)
1 HQDA (DAPC-PMZ-A)
1 HQDA (DACH-PPZ-A)
1 HQDA (DAPE-HRE)
1 HQDA (DAPE-MPO-C)
1 HQDA (DAPE-DW)
1 HQDA (DAPE-HRL)
1 HQDA (DAPE-CPS)
1 HQDA (DAFD-MFA)
1 HQDA (DARD-ARS-P)
1 HQDA (DAPC-PAS-A)
1 HQDA (DUSA-OR)
1 HQDA (DAMO-RQR)
1 HQDA (DASG)
1 HQDA (DA10-PI)
1 Chief, Consult Div (DA-OTSG), Adelphi, MD
1 Mil Asst, Hum Res, ODDR&E, OAD (E&LS)
1 HQ USARAL, APO Seattle, ATTN: ARAGP-R
1 HQ First Army, ATTN: AFKA-OI-TI
2 HQ Fifth Army, Ft Sam Houston
1 Dir, Army Stf Studies Ofc, ATTN: OAVCSA (DSP)
1 Ofc Chief of Stf, Studies Ofc
1 DCSPER, ATTN: CPS/OCP
1 The Army Lib, Pentagon, ATTN: RSB Chief
1 The Army Lib, Pentagon, ATTN: ANRAL
1 Ofc, Asst Sect of the Army (R&D)
1 Tech Support Ofc, OJCS
1 USASA, Arlington, ATTN: IARD-T
1 USA Rsch Ofc, Durham, ATTN: Life Sciences Dir
2 USARIEM, Natick, ATTN: SGRD-UE-CA
1 USATTC, Ft Clayton, ATTN: STETC-MO-A
1 USAIMA, Ft Bragg, ATTN: ATSU-CTD-OM
1 USAIMA, Ft Bragg, ATTN: Marquat Lib
1 US WAC Ctr & Sch, Ft McClellan, ATTN: Lib
1 US WAC Ctr & Sch, Ft McClellan, ATTN: Tng Dir
1 USA Quartermaster Sch, Ft Lee, ATTN: ATSM-TE
1 Intelligence Material Dev Ofc, EWL, Ft Holabird
1 USA SE Signal Sch, Ft Gordon, ATTN: ATSO-EA
1 USA Chaplain Ctr & Sch, Ft Hamilton, ATTN: ATSC-TE-RD
1 USATSCH, Ft Eustis, ATTN: Educ Advisor
1 USA War College, Carlisle Barracks, ATTN: Lib
2 WRAIR, Neuropsychiatry Div
1 DLI, SDA, Monterey
1 USA Concept Anal Agcy, Bethesda, ATTN: MOCA-WGC
1 USA Concept Anal Agcy, Bethesda, ATTN: MOCA-MR
1 USA Concept Anal Agcy, Bethesda, ATTN: MOCA-JF
1 USA Artic Test Ctr, APO Seattle, ATTN: STEAC-MO-ASL
1 USA Artic Test Ctr, APO Seattle, ATTN: AMSTE-PL-TS
1 USA Armament Cmd, Redstone Arsenal, ATTN: ATSK-TEM
1 USA Armament Cmd, Rock Island, ATTN: AMSAR-TDC
1 FAA-NAFEC, Atlantic City, ATTN: Library
1 FAA-NAFEC, Atlantic City, ATTN: Hum Engr Br
1 FAA Aeronautical Ctr, Oklahoma City, ATTN: AAC-44D
2 USA Fld Arty Sch, Ft Sill, ATTN: Library
1 USA Armor Sch, Ft Knox, ATTN: Library
1 USA Armor Sch, Ft Knox, ATTN: ATSB-DI-E
1 USA Armor Sch, Ft Knox, ATTN: ATSB-DT-TP
1 USA Armor Sch, Ft Knox, ATTN: ATSB-CD-AD
2 HQUSACDEC, Ft Ord, ATTN: Library
1 HQUSACDEC, Ft Ord, ATTN: ATEC-EX-E-Hum Factors
2 USAEEC, Ft Benjamin Harrison, ATTN: Library
1 USAPACDC, Ft Benjamin Harrison, ATTN: ATCP-HR
1 USA Comm-Elect Sch, Ft Monmouth, ATTN: ATSN-EA
1 USAEC, Ft Monmouth, ATTN: AMSEL-CT-HDP
1 USAEC, Ft Monmouth, ATTN: AMSEL-PA-P
1 USAEC, Ft Monmouth, ATTN: AMSEL-SI-CB
1 USAEC, Ft Monmouth, ATTN: C, Facl Dev Br
1 USA Materials Sys Anal Agcy, Aberdeen, ATTN: AMXSY-P
1 Edgewood Arsenal, Aberdeen, ATTN: SAREA-BL-H
1 USA Ord Ctr & Sch, Aberdeen, ATTN: ATSL-TEM-C
2 USA Hum Engr Lab, Aberdeen, ATTN: Library/Dir
1 USA Combat Arms Tng Bd, Ft Benning, ATTN: Ad Supervisor
1 USA Infantry Hum Rsch Unit, Ft Benning, ATTN: Chief
1 USA Infantry Bd, Ft Benning, ATTN: STEBC-TE-T
1 USASMA, Ft Bliss, ATTN: ATSS-LRC
1 USA Air Def Sch, Ft Bliss, ATTN: ATSA-CTD-ME
1 USA Air Def Sch, Ft Bliss, ATTN: Tech Lib
1 USA Air Def Bd, Ft Bliss, ATTN: FILES
1 USA Air Def Bd, Ft Bliss, ATTN: STEBD-PO
1 USA Cmd & General Stf College, Ft Leavenworth, ATTN: Lib
1 USA Cmd & General Stf College, Ft Leavenworth, ATTN: ATSW-SE-L
1 USA Cmd & General Stf College, Ft Leavenworth, ATTN: Ed Advisor
1 USA Combined Arms Cmbt Dev Act, Ft Leavenworth, ATTN: DepCdr
1 USA Combined Arms Cmbt Dev Act, Ft Leavenworth, ATTN: CCS
1 USA Combined Arms Cmbt Dev Act, Ft Leavenworth, ATTN: ATCASA
1 USA Combined Arms Cmbt Dev Act, Ft Leavenworth, ATTN: ATCACO-E
1 USA Combined Arms Cmbt Dev Act, Ft Leavenworth, ATTN: ATCACC-CI
1 USAECOM, Night Vision Lab, Ft Belvoir, ATTN: AMSEL-NV-SD
3 USA Computer Sys Cmd, Ft Belvoir, ATTN: Tech Library
1 USAMERDC, Ft Belvoir, ATTN: STSFB-DQ
1 USA Eng Sch, Ft Belvoir, ATTN: Library
1 USA Topographic Lab, Ft Belvoir, ATTN: ETL-TD-S
1 USA Topographic Lab, Ft Belvoir, ATTN: STINFO Center
1 USA Topographic Lab, Ft Belvoir, ATTN: ETL-GSL
1 USA Intelligence Ctr & Sch, Ft Huachuca, ATTN: CTD-MS
1 USA Intelligence Ctr & Sch, Ft Huachuca, ATTN: ATS-CTD-MS
1 USA Intelligence Ctr & Sch, Ft Huachuca, ATTN: ATSI-TE
1 USA Intelligence Ctr & Sch, Ft Huachuca, ATTN: ATSI-TEX-GS
1 USA Intelligence Ctr & Sch, Ft Huachuca, ATTN: ATSI-CTS-OR
1 USA Intelligence Ctr & Sch, Ft Huachuca, ATTN: ATSI-CTD-DT
1 USA Intelligence Ctr & Sch, Ft Huachuca, ATTN: ATSI-CTD-CS
1 USA Intelligence Ctr & Sch, Ft Huachuca, ATTN: DAS/SRD
1 USA Intelligence Ctr & Sch, Ft Huachuca, ATTN: ATSI-TEM
1 USA Intelligence Ctr & Sch, Ft Huachuca, ATTN: Library
1 CDR, HQ Ft Huachuca, ATTN: Tech Ref Div
2 CDR, USA Electronic Prvg Grd, ATTN: STEEP-MT-S
1 CDR, Project MASSTER, ATTN: Tech Info Center
1 Hq MASSTER, USATRADOC, LNO
1 Research Institute, HQ MASSTER, Ft Hood
1 USA Recruiting Cmd, Ft Sherdian, ATTN: USARCPM-P
1 Senior Army Adv., USAFAGOD/TAC, Elgin AF Aux Fld No. 9
1 HQ USARPAC, DCSPER, APO SF 96558, ATTN: GPPE-SE
1 Stimson Lib, Academy of Health Sciences, Ft Sam Houston
1 Marine Corps Inst., ATTN: Dean-MCI
1 HQUSMC, Commandant, ATTN: Code MTMT 51
1 HQUSMC, Commandant, ATTN: Code MPI-20
2 USCG Academy, New London, ATTN: Admission
2 USCG Academy, New London, ATTN: Library
1 USCG Training Ctr, NY, ATTN: CO
1 USCG Training Ctr, NY, ATTN: Educ Svc Ofc
1 USCG, Psychol Res Br, DC, ATTN: GP 1/62
1 HQ Mid-Range Br, MC Det, Quantico, ATTN: P&S Div

1 US Marine Corps Liaision Ofc, AMC, Alexandria, ATTN: AMCGS–F
1 USATRADOC, Ft Monroe, ATTN: ATRO–ED
6 USATRADOC, Ft Monroe, ATTN: ATPR–AD
1 USATRADOC, Ft Monroe, ATTN: ATTS–EA
1 USA Forces Cmd, Ft McPherson, ATTN: Library
2 USA Aviation Test Bd, Ft Rucker, ATTN: STEBG–PO
1 USA Agcy for Aviation Safety, Ft Rucker, ATTN: Library
1 USA Agcy for Aviation Safety, Ft Rucker, ATTN: Educ Advisor
1 USA Aviation Sch, Ft Rucker, ATTN: PO Drawer O
1 HQUSA Aviation Sys Cmd, St Louis, ATTN: AMSAV–ZDR
2 USA Aviation Sys Test Act., Edwards AFB, ATTN: SAVTE–T
1 USA Air Def Sch, Ft Bliss, ATTN: ATSA TEM
1 USA Air Mobility Rsch & Dev Lab, Moffett Fld, ATTN: SAVDL–AS
1 USA Aviation Sch, Res Tng Mgt, Ft Rucker, ATTN: ATST–T–RTM
1 USA Aviation Sch, CO, Ft Rucker, ATTN: ATST–D–A
1 HQ, USAMC, Alexandria, ATTN: AMXCD–TL
1 HQ, USAMC, Alexandria, ATTN: CDR
1 US Military Academy, West Point, ATTN: Serials Unit
1 US Military Academy, West Point, ATTN: Ofc of Milt Ldrshp
1 US Military Academy, West Point, ATTN: MAOR
1 USA Standardization Gp, UK, FPO NY, ATTN: MASE–GC
1 Ofc of Naval Rsch, Arlington, ATTN: Code 452
3 Ofc of Naval Rsch, Arlington, ATTN: Code 458
1 Ofc of Naval Rsch, Arlington, ATTN: Code 450
1 Ofc of Naval Rsch, Arlington, ATTN: Code 441
1 Naval Aerospc Med Res Lab, Pensacola, ATTN: Acous Sch Div
1 Naval Aerospc Med Res Lab, Pensacola, ATTN: Code L51
1 Naval Aerospc Med Res Lab, Pensacola, ATTN: Code L5
1 Chief of NavPers, ATTN: Pers-OR
1 NAVAIRSTA, Norfolk, ATTN: Safety Ctr
1 Nav Oceanographic, DC, ATTN: Code 6251, Charts & Tech
1 Center of Naval Anal, ATTN: Doc Ctr
1 NavAirSysCom, ATTN: AIR–5313C
1 Nav BuMed, ATTN: 713
1 NavHelicopterSubSqua 2, FPO SF 96601
1 AFHRL (FT) William AFB
1 AFHRL (TT) Lowry AFB
1 AFHRL (AS) WPAFB, OH
2 AFHRL (DOJZ) Brooks AFB
1 AFHRL (DOJN) Lackland AFB
1 HQUSAF (INYSD)
1 HQUSAF (DPXXA)
1 AFVTG (RD) Randolph AFB
3 AMRL (HE) WPAFB, OH
2 AF Inst of Tech, WPAFB, OH, ATTN: ENE/S'-
1 ATC (XPTD) Randolph AFB
1 USAF AeroMed Lib, Brooks AFB (SUL–4), ATTN: DOC SEC
1 AFOSR (NL), Arlington
1 AF Log Cmd, McClellan AFB, ATTN: ALC/DPCRB
1 Air Force Academy, CO, ATTN: Dept of Bel Scn
5 NavPers & Dev Ctr, San Diego
2 Navy Med Neuropsychiatric Rsch Unit, San Diego
1 Nav Electronic Lab, San Diego, ATTN: Res Lab
1 Nav TrngCen, San Diego, ATTN: Code 9000–Lib
1 NavPostGraSch, Monterey, ATTN: Code 55Aa
1 NavPostGraSch, Monterey, ATTN: Code 2124
1 NavTrngEquipCtr, Orlando, ATTN: Tech Lib
1 US Dept of Labor, DC, ATTN: Manpower Admin
1 US Dept of Justice, DC, ATTN: Drug Enforce Admin
1 Nat Bur of Standards, DC, ATTN: Computer Info Section
1 Nat Clearing House for MH–Info, Rockville
1 Denver Federal Ctr, Lakewood, ATTN: BLM
12 Defense Documentation Center
4 Dir Psych, Army Hq, Russell Ofcs, Canberra
1 Scientific Advsr, Mil Bd, Army Hq, Russell Ofcs, Canberra
1 Mil and Air Attache, Austrian Embassy
1 Centre de Recherche Des Facteurs, Humaine de la Defense Nationale, Brussels
2 Canadian Joint Staff Washington
1 C/Air Staff, Royal Canadian AF, ATTN: Pers Std Anal Br
3 Chief, Canadian Def Rsch Staff, ATTN: C/CRDS(W)
4 British Def Staff, British Embassy, Washington
1 Def & Civil Inst of Enviro Medicine, Canada
1 AIR CRESS, Kensington, ATTN: Info Sys Br
1 Militaerpsykologisk Tjeneste, Copehagen
1 Military Attache, French Embassy, ATTN: Doc Sec
1 Medecin Chef, C.E.R.P.A.–Arsenal, Toulon/Naval France
1 Prin Scientific Off, Appl Hum Engr Rsch Div, Ministry of Defense, New Delhi
1 Pers Rsch Ofc Library, AKA, Israel Defense Forces
1 Ministeris van Defensie, DOOP/KL Afd Sociaal Psychologische Zaken, The Hague, Netherlands